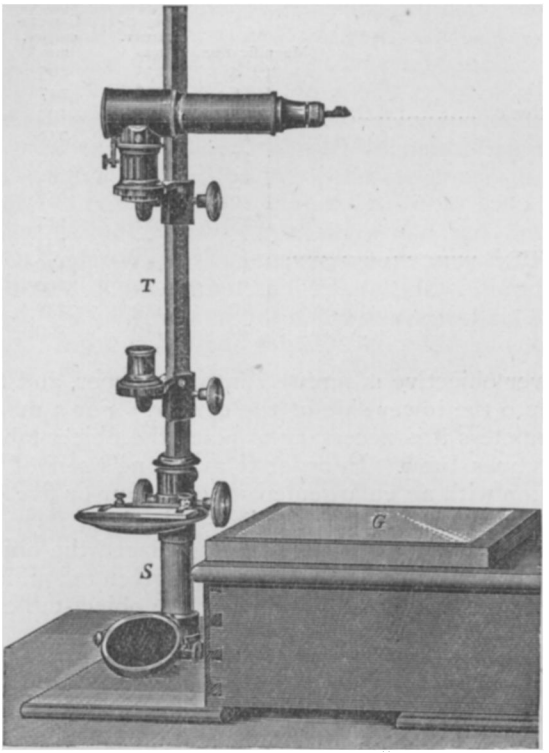
The prairie was unbroken where these hills were seen, though cultivated fields were not far distant. Query, Where did the ants get their sunflower seed?

There were three other gentlemen with me who observed and commented on this curious circumstance.—*Erving L. Richardson.*

MICROSCOPY.[1]

The Embryoscope.—The embryoscope devised by Hartnack[2] represents an improved form of the drawing apparatus introduced by Professor His.[3] The magnifying power of this instrument may be made to vary at pleasure from *four to seventy* diameters, thus offering the same facilities for making exact contour drawings with low powers that the microscope affords with higher powers.



For this wide range of magnification only two objectives are used. The height of the rod bearing the mirror, the object-table, the objective, and the camera lucida, is about 40 cm. The glass

[1] Edited by C. O. WHITMAN, Ph.D., Milwaukee, Wisconsin.
[2] Zeitschrift für Instrumentenkunde, Sept. 1881, p. 284.
[3] Anatomie menschlicher Embryonen, Leipzig, 1880, p. 8.

plate, *G*, resting on the étui, serves as a drawing surface. All parts of the apraratus can be packed in an étui measuring 38 cm. × 22.5 cm. × 9.5 cm.

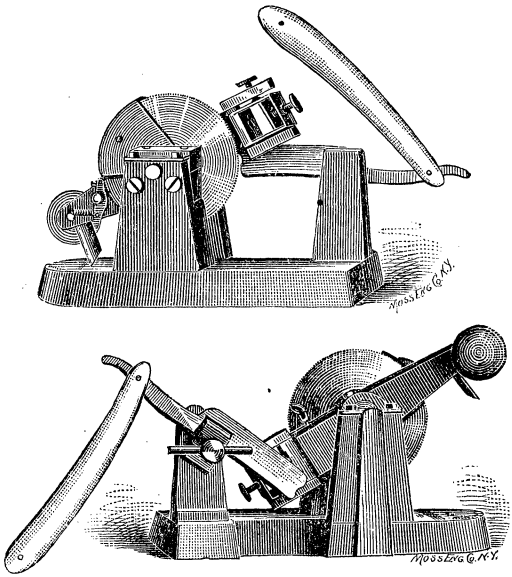
The magnifying power varies according to the relative positions given to the object-table, objective, and camera. The determination of these positions for different magnifications should be made before using the instrument. For this purpose a millimetre scale may be placed on the object-table, and the camera and objective moved until the picture projected on the drawing surface has the desired enlargement. The following table, showing the positions for given magnifications, was prepared by His. The numbers will vary somewhat for different eyes, hence the necessity of preparing one's own table.

	Magnification.	Upper edge of Object-carrier. mm.	Upper edge of Camera-carrier. mm.	Diameter of field of vision. mm.
Objective 0	4	235	265	32
	5	216	247	25
	8	115	193	20
	10	100	218	15
	15	83	240	11
Objective 1	15	13	65	—
	20	12	88	—
	25	11	112	8.5
	30	11	133	—
	40	11	170	—
	50	10	200	—
	60	10	230	3
	70	10	260	—

The lower objective is screwed into the upper, and the higher objective into the lower side of the carrier. For a magnification of four diameters it is necessary to place the object-table 20 mm. below its upper limit. In order to avail one's self of the whole field of vision with an enlargement of only four or five diameters, it is necessary to unscrew the object-table from its ring, and to use the latter alone as table. Having placed the objective and the camera in the positions required for a given magnification, the focal adjustment is effected by moving the object-table.

Ryder's Automatic Microtome.—This new instrument has been devised by Professor John A. Ryder, of the Biological Department of the University of Pennsylvania, in order to facilitate the preparation of sections for large classes, and also for the rapid preparation of series of sections in ribbons in embryological work, in which the element of time becomes a serious consideration. The device is small and compact and is also automatic,—that is, the same movement which cuts the section also brings the block into position for cutting the next successive section, and so on continuously, of any desired uniform thickness; the cutting takes

place as fast as it is possible to move a vibrating lever up and down through a distance of three inches with the right hand. Nearly all other automatic microtomes are costly, unwieldy, large and heavy, or else very complicated and liable to get out of order. The only exception in part to this rule is the Rocking Microtome, made in Cambridge, England; but it cuts in an arc, so that the sections are segments of a hollow cylinder, and not parts of a perfect plane; besides, the rocking or vibrating arm admits of only a very limited movement, so that the instrument is suitable only for cutting sections of objects of very limited dimensions; nor is the position of the block adjustable. Moreover, in none of the automatic microtomes now in use is it possible to place the knife at right angles or any other desired angle to the direc-



tion in which the block to be cut is moved,—a great desideratum in botanical or other work in which an inclined knife is necessary. In order to supply an instrument serviceable especially to teachers, as well as to all classes of students, botanists, pathologists, histologists, and zoologists, the designer has attempted to bring together all the desirable features of previously invented instruments, in as simple, convenient, and compact a form as possible, without sacrificing rapidity and efficiency of action.

The working parts are an oscillating lever, which is provided with a clamp at one end into which the paraffine-holders are adjusted, and at the other with a simple handle. This lever rests upon trunnions on either side, and these in turn rest in triangular notches at the top of the two pillars between which the lever

oscillates. At the cutting end of the lever a spring pulls the lever down and effects the sectioning and also the adjustment for the next section. The lever is pushed over and adjusted for the successive sections by a hollow screw, through which passes the trunnion on the side away from the knife. This screw is fixed to a toothed wheel, three inches in diameter, which revolves close by the side of the oscillating lever. The toothed wheel and screw is actuated by a pawl fixed to the side of the lever near the handle. The number of teeth which this pawl can pass in a single vibration downward is controlled by a fixed stop screwed into the under side of the oscillating lever near the handle; the end of this stop striking on the top of the bed-plate thus brings the lever to rest at a constant point in its downward excursion. An adjustable sector by the side of the toothed wheel throws the pawl out of gear after a given radius of the wheel has been turned through an arc embracing the desired number of teeth. This adjustment is also effected before the block, containing the object to be cut, reaches the edge of the knife. The adjustment for the next section is therefore effected while the surface of the block is not in contact with the under side of the knife, so that no flattening or scraping effect is produced on the surface of the block in its upward passage past the knife.

The movement of the vibrating lever being arrested at each down stroke at one point and the pawl which catches into the notches in the toothed wheel being released at any desired point by the action of the adjustable sector, it is possible to adjust the apparatus with great accuracy for cutting sections of any desired thickness. If a given radius of the wheel is moved through the arc embraced by a single tooth, sections are cut having a thickness of only $\frac{1}{10000}$ of an inch, or .0025 mm.,—a thickness which is only practically possible with paraffine embedding and a very keen razor. If more teeth are taken by the pawl, any thickness of section is possible up to about $\frac{1}{400}$ of an inch, or .0625 mm.[1]

A freezing attachment which has lately been appended to the apparatus shows that frozen sections can be made with as great rapidity and success as those cut from objects embedded in the paraffine block, and very nearly, if not quite, as thin. The freezing attachment is as simple and efficient as the self-adjusting and cutting devices of the instrument. Other auxiliary apparatus makes it possible to cut celloidin sections. This is effected by means of alcohol conducted by a tube from a reservoir to the knife, over which the fluid will run and drain into a tray below in such a way as not to come in contact with any other parts of the machine. This tray fits into a recess in the side of the bed-

[1] The screw which adjusts the block for cutting has exactly fifty threads to the inch, and there are two hundred teeth on the periphery of the toothed wheel. The value of a single tooth is, therefore, $\frac{1}{50} \times \frac{1}{200} = \frac{1}{10000}$ inch.

plate of the instrument just below the knife, and into this tray the celloidin sections may be allowed to drop as fast as cut.

The paraffine-holders are square and seven-eighths of an inch in diameter, so that a block of that size may very readily be sectioned. For the botanist, one of these holders is provided with a movable side and screw for clamping objects, so that rather tough stems may be firmly held between blocks of cork, while the more delicate vegetable tissues, or such as must be embedded in fresh carrot, soaked in gum and hardened in alcohol, may also be firmly held for sectioning by the same device, provided the pieces of carrot are first trimmed into the right shape. The same style of holder is equally applicable for holding the corks—if properly trimmed—upon which tissues are embedded in celloidin or in gum. This style of holder also enables one to embed very long objects entire in paraffine,—such as earth-worms,—and to cut them as a single piece, provided the surrounding paraffine is carefully trimmed so as to have two opposite sides parallel. An object six inches long and three-fourths of an inch in diameter embedded in this way may be cut into an absolutely continuous series of sections without losing any essential portions. This is accomplished by slipping the block through the quadrangular clamp for the distance of half an inch every time a half-inch of the object has been cut off in the form of sections. One-half inch is the length of block which can be cut at one time without readjusting the feed-screw which moves the block and vibrating lever over towards the knife, the whole being kept firmly in place against the face of the hollow screw by a strong spring which presses against the end of the trunnion on the outside of the iron pillar on that side of the instrument where the knife is fastened, so that all the sections are of exactly the same thickness from first to last. Cutting up large objects in the manner above described is not possible with any other form of microtome yet constructed.

Almost any section-knife—wide- or narrow-bladed—will fit into and be firmly held by the knife-clamp, which is, however, intended more especially to hold an ordinary razor. The best razors for cutting sections have been found to be those of the best make only, such as Wade & Butcher, or Joseph Rodgers & Sons, of Sheffield. Only such razors as hold an edge well should be used.

For ribbon-cutting by the paraffine method the block containing the object, after it is trimmed and soldered to the paraffine with which the holder is filled, by means of a heated wire, is covered with a thin coat of soft paraffine or "paraffine-gum," and of which "chewing-gum"[1] is made. This enables one to cut

[1] Chewing-gum may be rendered available for this purpose if it is melted at a temperature somewhat above boiling, when the sugar which it contains will separate as caramel, leaving the pure paraffine-gum, which may be drained off and used as

ribbons of any desired length, since the softer paraffine at the edges of the successive sections sticks them together by their margins as fast as they are cut.

The ribbons may be allowed to fall upon a slip of paper, which may be drawn out, as fast as the sections are cut, from under the bed-plate of the instrument, beneath which there is a space left for this purpose between the three toes or tripod upon which whole apparatus rests. The edge of the knife also remains in the same plane, no matter at what angle the cutting edge is placed with reference to the direction in which the block to be cut is moved, just as in the best forms of the sledge microtome.

The advantages which this new instrument offers are, briefly, comparatively small cost, great efficiency, rapidity, and accuracy. One hundred sections per minute may very readily be cut with it. Its simplicity of construction, with few wearing parts, and slight liability to get out of order in the hands of inexperienced persons, will also commend it to the teacher and investigator. Experience has already shown that those once using it can scarcely ever be again induced to use the most efficient sledge or automatic microtomes of different design if they can have access to this instrument. This device is made by Mr. Zentmayer, whose name is a sufficient guarantee of the workmanship employed in its construction.

SCIENTIFIC NEWS.

—William Willoughby Cole, the Earl of Enniskillen, who died November 12, 1886, was the possessor of one of the largest collections of fossil fishes in existence. He was associated with Sir Philip Grey Egerton in preparing the catalogue of fossil fishes so useful to geologists.

—Henry Woodward, of the British Museum, is preparing a third edition of Morris's "Catalogue of British Fossils," to be issued by the Cambridge University Press this year.

—C. E. Broome, an English mycologist, died at Bath, England, November 15, 1886.

—Karl Goebel, professor of botany at Rostock, is called to Marburg to take the chair left vacant by the death of Professor Wigand.

—Culver Hall, at Dartmouth College, caught fire, Sunday, February 20, and the geological and zoological collections of the college had a narrow escape from destruction.

directed, if the manipulator should find it difficult to get the paraffine-gum of commerce.